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ABSTRACT

Evaluation results are reported for the Southwest Educational Development Laboratory's Thinking and Reasoning Program, designed to develop analytic thinking and problem-solving skills in young children in multicultural classroom settings. Results are based on a pilot test of the program conducted during the 1974-75 school year. Mastery activities, constructed to serve as transfer tasks for several lesson sequences, were administered on a pre/post sequence basis to six kindergarten and three first-grade project classrooms and to three kindergarten and two first-grade comparison classrooms. Classrooms were ethnically mixed. Analyses of covariance demonstrated that both the kindergarten and first-grade project groups significantly outperformed their respective comparison groups in the analytic thinking areas of observing, causal reasoning, and flexibility. (Author/BF)

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THE DEVELOPMENT OF THINKING AND REASONING SKILLS IN YOUNG CHILDREN[1]

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Evaluation results are reported for the Southwest Educational Development Laboratory's Thinking and Reasoning Program which is designed to develop analytic thinking and problem-solving skills in young children in multicultural classroom settings. Mastery Activities, constructed to serve as transfer tasks for several lesson sequences, were administered on a pre/post sequence basis to six kindergarten and three grade 1 project classrooms and to three kindergarten and two grade 1 comparison classrooms. Analyses of covariance demonstrated that both the kindergarten and grade 1 project groups significantly outperformed their respective comparison groups in the analytic thinking areas of observing, causal reasoning, and flexibility.

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THE DEVELOPMENT OF THINKING AND REASONING SKILLS IN YOUNG CHILDREN[1]

The purpose of this paper is to report evaluation results of a program designed to develop skills related to thinking and reasoning in kindergarten through second grade children in multicultural classroom settings. The results are based on a pilot test of the program which was conducted during the 1974-75 school year. Prior to moving into the research portion of this study, information pertinent to the program's background will be addressed.

PERSPECTIVE

A child is faced daily with the necessity of addressing and solving problems encountered in the school, social, and home environments. To one degree or another, the child will seek out solutions with his/her own devices that will enable him/her to maintain a functioning relationship with the environments. The extent to which solutions arise out of personality predispositions (e.g., self confidence, persistence) on the one hand and cognitive responses on the other determines the success factor the child experiences in developing analytic thinking, problem-solving, and personality skills which will be useful in later years.

Once it was established, through staff reviews of the literature and available curricula (Freeman and Stern, 1972; Levy, 1975), that a need existed in the early elementary grades for a curriculum emphasizing cognitive and personality skills important to problem-solving, there remained the need to identify the specific goals one curriculum could

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[1]The Thinking and Reasoning Program of the Southwest Educational Development Laboratory was most fortunate to have the outstanding cooperation from the teachers and principals in the following schools during the 1974-75 school year: Bonham Elementary in San Marcos, Texas and Becker, Norman, Pease, and Sims Elementary Schools in Austin, Texas.

effectively address. The primary goal of the Thinking and Reasoning Program was identified as the development of children's independent problem-solving skills. Recognizing problem-solving as perhaps the most complex type of human learning, the problem-solving process was analyzed to determine what skills must be preavailable to the learner who is confronted with a problem. This analysis led to the selection of the following four subgoals--the development, integration, and coordination of: 1) analytic thinking skills, 2) personality skills; 3) a five-stage problem-solving process, and 4) process awareness and control.

Subsequent to identifying a target population of children in multicultural classroom settings, the Thinking and Reasoning Program of the Southwest Educational Development Laboratory in Austin, Texas was developed for and tested with kindergarten through second grade children in these settings. The Program, designed to be taught throughout the school year 45 minutes to an hour five days a week, makes use of both a formal learning mode through teacher-directed lesson activities and an informal learning mode through the use of commercially available games. The three elements which make up the Thinking and Reasoning Program are the lesson activities, a games program, and supporting staff development materials. Since, however, the evaluation results deal with analyses of Mastery Activities keyed to the lesson objectives, descriptions in this abstract will be limited to those related to the lessons, although the games program and staff development materials are important to accomplishing the program goals.

The lesson activities include 26 kindergarten/grade 1 lessons, 26 grade 1/grade 2 lessons, assessment instruments, record keeping instruments,

and extensive teacher training materials. Both sets of lessons have four sequences, each sequence focusing on discrete thinking processes: 1) Observing and Describing; 2) Predicting and Inferring; 3) Thinking of Unusual Uses; and 4) Solving Problems. Each sequence is accompanied by manipulative materials for each child in each lesson, a motivation filmstrip to introduce the sequence, and a series of posters to complement the sequence's focus.

Based on feedback from small scale testing in previous stages, the Program was revised in a major way and underwent Design Test (1972-73) in four ethnically mixed kindergarten and grade 1 classrooms in Austin, Texas. The Program then proceeded through pilot test stages--Pilot Test I (1973-74) in six ethnically mixed classrooms in the Austin area, and Pilot Test II (1974-75) in nine ethnically mixed classrooms in the Austin area--and will enter the final development stage, Field Test, during the 1975-76 school year in 30 ethnically mixed classrooms in Texas, Louisiana, and California. From each of the Design and Pilot Test stages, extensive formative and summative data were collected and used in the refinement and validation of the Program.

The results reported in this paper are based on the Pilot Test II conducted during the 1974-75 school year.

METHOD

Subjects. The project groups consisted of six kindergarten and three grade 1 ethnically mixed classrooms and the comparison groups consisted of three kindergarten and two grade 1 ethnically mixed classrooms. The project and comparison groups were selected on the basis of availability but pupils in both groups were similar in terms of sex, grade level, and ethnicity and were judged by the participating teachers as being comparable in overall academic ability.

Procedure. From October 1974 through May 1975 pupils in the kindergarten and grade 1 project groups received instruction in the four previously mentioned sequences, each sequence containing five to eight 15-20 minute lesson activities which were taught to small groups of four to six pupils. The kindergarten and grade 1 lesson activity sequences were similar in content focus but dissimilar in terms of approach due to the differing developmental levels of the pupils. During the daily Thinking and Reasoning period, pupils not engaged in the lesson activiti were involved in the game activities. Pupils in the comparison groups received no special instruction. For the most part, the pupils in the project and comparison groups were exposed to the same kinds of curricula during the school year with the exception of the project pupils' exposure to the Thinking and Reasoning curriculum.

Eight Mastery Activities were constructed to serve as transfer tasks for each of the four kindergarten and grade 1 sequences. These Mastery Activities were administered individually on a pre/post basis to both the project and comparison pupils at a time prior to and after the project pupils were involved with each sequence. Each Mastery Activity consisted of three trials of the task of interest, the results of which were averaged across trials, and appropriate randomization procedures were applied to minimize various sources of bias.

SUMMARY OF RESULTS

Kindergarten pupils. Analyses of covariance performed on pre/post administrations of the Observing and Describing sequence Mastery Activity produced five out of six statistically significant differences in favor of the project group: a) number of properties of objects named, $F(1,100) = 7.66$, $p < .01$; b) number of properties named by category (e.g., the responses blue and red would be considered as one category--color--

whereas the responses blue and hard would be considered as two categories), $F(1,100) = 11.10$, $p < .01$; c) number of similarities among objects named, $F(1,100) = 9.25$, $p < .01$; d) number of similarities named by category, $F(1,100) = 7.81$, $p < .01$: e) number of differences among objects named by category, $F(1,100) = 5.59$, $p < .05$. The number of differences among objects named was not statistically different between the two groups.

Analyses of covariance performed on pre/post administrations of the Predicting and Inferring sequence Mastery Activity produced two out of four statistically significant differences in favor of the project group: a) number of reasons given for the choice of a causal agent, $F(1,160) = 28.60$, $p < .001$; and b) ability to resist irrelevant information, $F(1,160) = 8.11$, $p < .01$. The failure to find statistically significant differences for the other two variables was anticipated as these two variables were not considered to be major objectives, but rather served as a means of introducing the more important variables.

For the Thinking of Unusual Uses sequence Mastery Activities, analyses of covariance on the pre/post administrations revealed that both variables of interest were statistically significant in favor of the project group: a) total number of unusual uses named for an object, $F(1,140) = 33.69$, $p < .001$; and b) number of reasons given for choice of the unusual use, $F(1,140) = 13.05$, $p < .001$.

Grade 1 pupils. Covariance analyses on pre/post administrations of the Observing and Describing sequence Mastery Activity indicated that five out of six variables were statistically significant in favor of the project group: a) number of ways given that an object was changing, $F(1,129) = 19.28$, $p < .001$; b) number of ways given that an object was different than before, $F(1,129) = 22.46$, $p < .001$; c) number of ways given that an object

was different by category, $F\ (1,129) = 4.62$, $p < .05$; d) number of similarities among objects named, $F\ (1,129) = 4.25$, $p < .05$; and e) number of similarities among objects named by category, $F\ (1,129) = 8.20$, $p < .01$. The number of differences among objects named was not statistically different between the two groups.

Covariance analyses on pre/post administrations of the Predicting and Inferring sequence Mastery Activity revealed that two out of four variables were statistically different in favor of the project group: a) number of reasons given for a prediction, $F\ (1,119) = 12.99$, $p < .001$; and b) number of reasons given for choice of a causal agent, $F\ (1,119) = 34.98$, $p < .001$. As was the case with the Predicting and Inferring sequence Mastery Activity for the kindergarten pupils, the two nonsignificant variables were not considered to be major objectives.

Analyses of covariance performed on pre/post administrations of the Thinking of Unusual Uses sequence Mastery Activity indicated that both variables of interest were statistically significant in favor of the project group: a) total number of unusual uses named for an object, $F\ (1,118) = 12.89$, $p < .001$; and b) number of reasons given for choice of the unusual use, $F\ (1,118) = 7.68$, $p < .01$.

The results of the fourth sequence, Solving Problems, are not reported for either the kindergarten or grade 1 groups since it became obvious half way through the teaching of the lesson activities that there were major problems with the approach being used to accomplish the sequence objectives. Consequently, this sequence of lesson activities was revised and was tested during the 1975-76 school year.

EDUCATIONAL IMPORTANCE

This paper is important to the educational field in that it reports evaluation results of a program for young children which, under the conditions specified, has been successful in developing analytic thinking skills (i.e., observing, causal reasoning, and flexibility) important to problem solving. Based on the data reported in this study and data collected from teacher reports and staff observations, the lesson activity sequences of the Thinking and Reasoning Program underwent revisions prior to entering the final stage of testing during the 1975-76 school year. Analysis of the 1975-76 data has yet to be finalized.

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